Chapter 8

Binomial Random Variables

AP Statistics

2013-2014

AP Statistics

3rd Six weeks (2013-2014)

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
November 11	12	13	14	15
Sampling Designs HW: 5.20,5.21,5.24, 5.25,5.26,5.28,5.30	Random Rectangle Activity HW: What Sampling Method Would be Best?	**Quiz 5.1** Go over Random Rectangle Activity HW: WS	Experimental Designs HW: 5.35 and 5.36	Computer Lab for Fall Project
18	19	20	21	22
Randomized Experiments HW: 5.38-5.43 5.45-5.48	**Quiz 5.2** **Take Home** HW: Review	Chapter 5 Review Work WS Free Response in class. HW: 5.74,5.75,5.83,5.87	**Chapter 5 Test**	Intro to Random Variables HW: 7.3, 7.4, 7.5
25	26	27	28	29
Continuous Random Variables HW: 7.6-7.8, 7.13-7.17odd **Project Due**	**Activity: Simulation**	Thanksgiving Holiday	Thanksgiving Holiday	Thanksgiving Holiday
Dec 2	3	4	5	6
Means and Variances of Random Variables HW: 7.22, 7.28, 7.34, 7.36, 7.37, 7.41,7.46, 7.60, 7.61	Calculating Expected Value/Law of Large Numbers HW: Worksheet 7.24,7.25,7.32,7.33	Chapter 7 Review HW: Review Sheet	**Chapter 7 Test**	Binomial Distribution HW: WS
9	10	11	12	13
Binomial Formula HW: WS	Normal Approximation to a Binomial Distribution HW: WS	**Quiz 8.1** HW: Final Exam Review	Final Exam Review	Final Exam Review
16	17	18	19	20
Final Exams	**Final Exams**	**Final Exams**	**Final Exams**	**Final Exams**

****All assignments subject to last minute changes!**

4^{th} six weeks (2013-2014) AP Stats

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
January 6	7	8	9	10
Holiday	Review Binomial HW: Worksheet	Review Normal Approximations/ Standard Normal Calculations HW: WS	Intro To Geometric Distributions	Binomial/Geometric Distributions Mixed HW: WS #2
13	14	15	16	17
Simulation HW: Review Sheet	Chapter 8 Review HW: Review Sheet	Chapter 8 Test HW: Short Sampling Dist. Activity	Sampling Distributions. (Video) HW: 9.1-9.4, 9.10-9.13	Intro to Sample Means HW: WS 9-3 #1
20	21	22	23	24
Holiday	**Quiz – 9.3** HW: WS 9-3 #2	More Sampling Distribution Practice WS #3 in class HW: Review	Chapter 9 Review HW: AP Problem Set	Intro to Confidence Intervals HW: Activity Write-up 10.1-10.4
27	28	29	30	31
Chapter 9 Test HW: AP Quiz Review #1	Confidence Intervals and z* HW: 10.5 – 10.11	Desired Sample Size HW: 10.12 – 10.18 Skip 10.17	**Quiz 10.1** HW: AP Problem Set	Intro to Tests of Significance HW: W/S and 10.29-10.32
February 3	4	5	6	7
Tests of Significance HW: Worksheet	Tests of Significance (continued) Review #1	**Quiz 10.2** HW: Review #2	Practical vs Statistical Significance/Tests from Confidence Intervals HW: Review	**Test 10.1 and 10.2** HW: AP Quiz Review #5
10	11	12	13	14
Error of a Decision HW: Worksheet	Type II Error and Power HW: WS	Type II Error and Power HW: Quiz Review 10.72, 10.73 optional	**Quiz** HW: Review Sheet	Review
17	18	19	20	21
Professional Learning Day Student Holiday	Intro to T – Tests HW: WS 11.3,11.4,11.8,11. 10	**Test 10.1 to 10.4**	Matched Pairs T-Tests HW: Worksheet	**Half Day** HW: Probability Review

**All assignments are subject to last minute changes!!!

Name ______________________________ Period ________________

Binomial Distributions Questions

A free-throw shooter has a 70% average for making free-throws. Out of 20 attempts, find the following probabilities:

1. P(10 makes)

2. P(at least 10 makes)

3. P(17 makes)

4. P(at most 17 makes)

5. P(20 makes)

6. P(5 makes)

7. P(16 or more makes)

8. P(11 makes)

9. P(at most 11 makes

10. P(at least 11 makes)

11. P(between 12 to 17 makes)

12. P(from 12 to 17 makes inclusive)

12. How many free-throws do you expect this shooter to make?

13. If the probability that a light bulb is defective is .1, what is the probability that exactly 3 of 8 light bulbs are defective? At **most** 3 of 8 are defective?

14. Suppose that 30% of employees in a large factory are smokers. What is the probability that there will be exactly two smokers in a randomly chosen five-person work group?
At **least** 2 smokers in the same group?

15. Joe DiMaggio had a career batting average of .325. What was the probability that he would get at **least** one hit in five official at-bats?

16. A manager notes that there is a .125 probability that any employee will arrive late for work. What is the probability that exactly one person in a six person department will arrive late?

17. A manufacturer has the following quality control check at the end of a production line: If at least 8 of 10 randomly selected articles meet all specifications, the whole shipment is approved. If, in reality, 85 % of a particular shipment meets all specifications, what is the probability that the shipment will make it through the control check?

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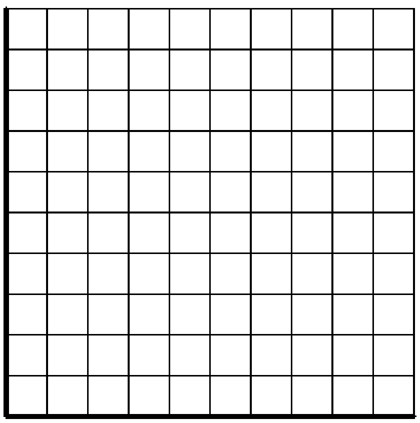
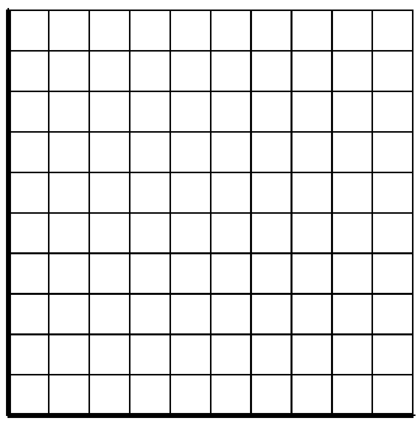
Binomial Distribution Worksheet

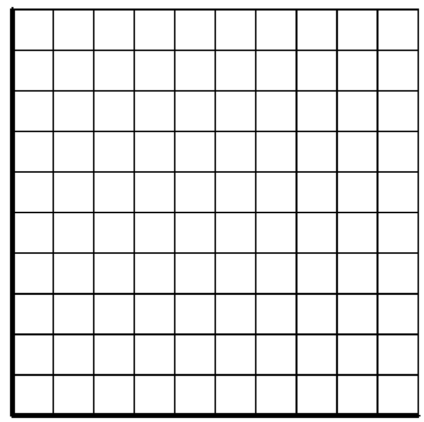
1) List the four rules of a binomial setting.

1.
2.
3.
4.

2) Consider a basketball player shooting 8 free-throws. Produce a probability histogram for a 20% success rate, a 50% success rate and an 80% success rate. Draw them in the grids







3) Calculate the mean and standard deviation for each of the three success rates listed in problem #2. At which probability value is the spread (standard deviation) the biggest?

20% 50% 80%

4) Write out the formula for calculating probabilities in a binomial setting. Then use the formula to calculate the above free-throw shooter makes exactly 5 free-throws, assuming an 80% success rate.

5) A certain tennis player makes a successful serve 70% of the time. Assume that each serve is independent of the others. If she serves 6 times, what is the probability that she gets

a) all 6 serves in?
b) exactly 4 serves in?
c) at least 4 serves in?
d) no more than 4 serves in?

6) An orchard owner knows he'll have to use 6% of the apples he harvests for cider because they will have bruises or blemishes. He expects a tree to produce 300 apples.

a) Describe an appropriate model for the number of cider apples that may come from a tree. Justify your model.
b) Find the probability there will be no more than a dozen cider apples.
c) Is it likely there will be more than 50 cider apples? Explain.

7) An Olympic archer is able to hit a bulls-eye 80% of the time. Assume each shot is independent of the others. If she shoots 15 arrows, what is the probability of each result described below?

a) What is the expected number of bulls-eyes for the 15 attempts? What is the standard deviation?
b) What is the probability that she never misses?
c) She gets exactly 11 bulls-eyes?
d) She gets between 9 and 13 bulls-eyes?
e) She gets less than 8 bulls-eyes?
f) She gets at least 8 bulls-eyes?
g) She gets at most 10 bulls-eyes?
h) She gets between 9 and 13 bulls-eyes inclusive?

8) An airline, believing that 5% of passengers fail to show up for flights, overbook the flights. Suppose a plane will hold 265 passengers, and the airline sells 275 tickets. What is the probability the airline will not have enough seats so someone gets bumped off the flight?

9) A lecture hall has 200 seats with folding arm tablets (writing surfaces), 30 of which are designed for left-handers. The average sizes of the classes that meet there is 188, and we can assume that 13% of the students are left-handed. What is the probability that a right-handed student in one of these classes is forced to use a left arm tablet?

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Normal Approximation to a Binomial Distribution

Solve the following problems using both binomial calculations AND the normal approximation to the binomial. Show work!

1. The 57% of cat owners greet their pet before spouse or children. If twenty cat owners are randomly selected, find the following probabilities:

   a) 12 or more owners will greet their pet first.
   b) at least 8 owners will greet their pet first.
   c) more than 15 owners will greet their pet first.
   d) below 10 owners will greet their pet first.
   e) exactly 14 owners will greet their pets first.

2. It is estimated that 20% of the members of a health club have high blood pressure.

   a) If 150 members of a club are randomly selected, about how many of them can be expected to have high blood pressure? What is the standard deviation? Do these values lend themselves to doing a normal approximation to a binomial distribution?
   b) What is the probability of 35 members having high blood pressure?
   c) What is the probability of more than 40 members having high blood pressure?
   d) What is the probability of at most 53 members having high blood pressure?
   e) What is the probability of between 33 and 51 members having high blood pressure?
   e) What is the probability of between 29 and 43 (inclusive) members having high blood pressure?

3. Suppose that 25% of the fire alarms in a city are false alarms. Let X denote the number of false alarms in a random sample of 100 alarms. Find the probabilities for the following number of false alarms:

   a) $P(20 \leq X \leq 30)$
   b) $P(20 < X < 30)$
   c) $P(X \geq 35)$
   d) *P*(*X* is farther than 2 standard deviations from it's mean value)

4. Suppose that 15% of the cars coming out of an assembly plant have some defect. In a delivery of 40 cars, what is the probability that exactly 5 cars have defects?

5. If 60% of the population supports massive federal budget cuts, what is the probability that in a survey of 250 people, at most 155 people support such cuts?

6. Assume that a baseball team has an average pitcher, that is, one whose probability of winning any decision is .5. If this pitcher has 30 decisions in a season, what is the probability that he will win at least 20 games? Use the normal approximation only.
   a) .0505
   b) .2514
   c) .2743
   d) .3333
   e) .4300

Name ______________________________________ Period ___________________

Binomial Review

1. According to an article appearing in the *New York Times Almanac*, about 70 % of all US households have a cellular phone. Suppose you are conducting a survey of customer satisfaction regarding cellular phones. If you called 11 homes at random, what is the probability that

   (a) every household has a cell phone?
   (b) more than four households have a cell phone?
   (c) fewer than five households do not have a cell phone?
   (d) more than 7 households do not have a cell phone?

2. After examination of daily receipts over the past year, it was found that the Green Parrot Italian Restaurant has been grossing over $2200 a day for about 85% of its business days. Using this as a reasonably accurate measure, find the probability that the Green Parrot will gross over $2200

   (a) at least 5 of the next 7 business days.
   (b) at least 5 of the next 10 business day.
   (c) fewer than 3 days in the next 10 business days.
   (d) fewer than 7 days in the next 10 business days.
   (e) fewer than 3 days in the next 7 business days. If this actually happened, might it shake your confidence in the statement $p = 0.85$? Might you suspect that p is less than .85? Explain.

3. Richard had just been given a 10-question multiple-choice quiz in his Statistics class. Each question has 5 answer choices, of which only one is correct (although several seem correct! ☺) Since Richard never does homework, sleeps in class, and never works at anything, he has no idea what the questions are asking and decides to guess. Assuming that Richard guesses on all 10 questions, find the indicated probabilities.

   (a) What is the probability he will answer all 10 questions correctly?
   (b) What is the probability he will answer all 10 questions incorrectly?
   (c) What is the probability he will answer at least one of the questions correctly?
   (d) What is the probability he will answer at least half of the questions correctly?

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Review of Standard Normal Calculations
And the Normal Approximation to a Binomial Distribution

1. The Virginia Cooperative Extension reports that the mean weight of yearling Angus steers is 1152 pounds. Suppose the weights of all such animals can be described by a Normal model with a standard deviation of 84 pounds.

   (a) Describe this distribution using short-hand notation.

   (b) How many standard deviations from the mean would a steer weighing 1000 pounds be?

   (c) Which would be more unusual, a steer weighing 1000 pounds, or one weighing 1250 pounds?

   (d) What percent of steers weigh:

   over 1300 pounds?

   under 1200 pounds?

   between 1000 and 1100 pounds?

   (e) How much should a steer weigh to be among the lowest 20% by weight? How much should one weigh to exceed 90% of all steers?

2. Assume the cholesterol levels of adult American women can be described by a Normal model with a mean of 188 mg/dL of blood with a standard deviation of 24.

(a) Draw and label a Normal curve to fit this situation. Include ±3 standard deviations.

(b) What percent of all adult women do you expect to have cholesterol levels over 200 mg/dL?

(c) What percent of adult women do you expect to have cholesterol levels between 150 and 170 mg/dL?

(d) Estimate the interquartile range of the cholesterol levels.

(e) What cholesterol readings would exceed 80% of the population's readings?

3. Companies who design furniture for elementary school classrooms produce a variety of sizes for kids of different ages. Suppose the heights of kindergarten children can be described as N(38.2, 1.8) as measured in inches.

(a) What proportion of kindergarten children should the company expect to be less than 3 feet tall?

(b) What percent of kindergarten children should the company expect to be more than 42 inches tall?

(c) In what height interval should the company expect to find the middle 80% of kindergarteners?

(d) At least how tall are the biggest 60% of kindergarteners?

4. About 40% of all US adults try to "pad" their insurance claim (they ask for more than the claim is worth). Suppose that you are the director of an insurance adjustment office. Your office has just received 128 insurance claims to be processed in the next few days. Determine the following probabilities **using a Normal Approximation to a Binomial Distribution**.

(a) Half or more of the claims have been padded.

(b) Less than 45 claims have been padded.

(c) From 40 to 64 inclusive claims have been padded.

(d) More than 55 claims have been padded.

(e) More than 80 of the claims have **not** been padded.

(f) Between 53 and 60 claims have been padded.

(g) Exactly 52 claims have been padded.

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Geometric Probability Distribution

x = the number of trials until the first success is observed
p= probability of "success" on a single trial

mean: $\mu = \dfrac{1}{p}$ variance: $\sigma^2 = \dfrac{1-p}{p^2}$ sd: $\sigma = \sqrt{\dfrac{1-p}{p^2}}$

Examples:
- first car arriving at a service station that needs brake work
- flipping a coin until the first tail is observed
- first plane arriving at an airport that needs repair
- number of house showings before a home sale is concluded
- length of time (in days) between sales of a large computer system

Exercises. Show your work on a separate sheet of paper.

1. State the four rules for a geometric setting.

2. Write the general formula for calculating geometric probabilities.

3. The drilling records for an oil company suggest that the probability the company will hit oil in productive quantities at a certain offshore location is .2. Suppose the company plans to drill a series of wells.

   (a) Define the geometric random variable.

   (b) What is the probability that the 4th well drilled will be productive?

   (c) What is the probability that the 7th well drilled will be productive?

   (d) Is it likely that X could be as large as 15?

   (e) Find the mean and the standard deviation of the number of wells that must be drilled before the company hits its first productive well.

4. An insurance company expects its salespersons to achieve minimum monthly sales of $50,000. Suppose that the probability that a particular salesperson sell $50,000 of insurance in any given month is .84. If the sales in any one month are independent of the sales in any other, what is the probability that exactly three months will elapse before the salesperson reaches the acceptable minimum monthly goal?

5. An automobile assembly plant produces sheet metal door panels. Each panel moves on an assembly line. As the panel passes a robot, a mechanical arm will perform spot welding at different locations. Each location has a magnetic dot painted where the weld is to be made. The robot is programmed to locate the dot and perform the weld. Experience shows, however, that the robot is only 85% successful at locating the dot. If it cannot locate the dot, it is programmed to try again. The robot will keep trying until it finds the dot, or the panel moves out of range.

   (a) What is the probability that the robot's first attempt will be on attempts $n = 1$ or $n = 2$ tries?
   (b) The assembly line moves so fast that the robot only has a maximum of three chances before the door panel is out of reach. What is the probability that the robot is successful in completing the weld before the panel is out of reach?
   (c) What is the probability that the robot will not be able to locate the correct spot within three tries? If 10,000 door panels are made, what is the expected number of defective panels? This would indicate a limit in design and would also be an indicator of our ability to forecast "failure of design".

6. Suppose a computer chip manufacturer rejects 2% of the chips produced because they fail quality control checks.

   (a) What is the probability that the 5^{th} chip you test if the first bad one you find.
   (b) What is the probability you find a bad one within the first 10 you examine?

7. Only 4% of people have Type AB blood.

   (a) On average, how many donors must be checked to find someone with Type AB blood.
   (b) What is the probability that there is a Type AB donor among the first 5 people checked?
   (c) What is the probability that the first Type AB donor will be among the first 6 people?
   (d) What is the probability that we won't find a Type AB donor before the 10^{th} person?

8. About 8% of males are colorblind. A researcher needs some colorblind subjects for an experiment and begins checking potential subjects.

   (a) On average, how many men should the researcher expect to check to find one who is colorblind?
   (b) What is the probability that she won't find anyone colorblind among the first 4 men checked?
   (c) What is the probability that the first colorblind man found will be the 6^{th} person checked?
   (d) What is the probability that she finds someone who is colorblind before checking the 10^{th} man?

9. An Olympic archer is able to hit bull's-eyes 80% of the time. Assume each shot is independent of the others. If she shoots 6 arrows, what is the probability of each result described below. Be careful, some of the questions might not fit a geometric distribution.

   (a) Her first bull's-eye comes on the third arrow.
   (b) Misses the bull's eye at least once.
   (c) Gets exactly 4 bull's-eyes.
   (d) Gets at least 4 bull's-eyes.
   (e) Gets at most 4 bull's-eyes.

Also do the following textbook problems: 8.37 - 8.41, 8.45

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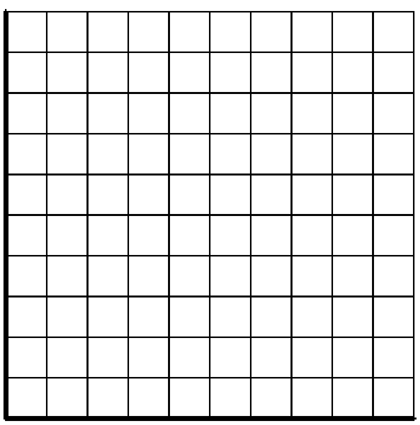
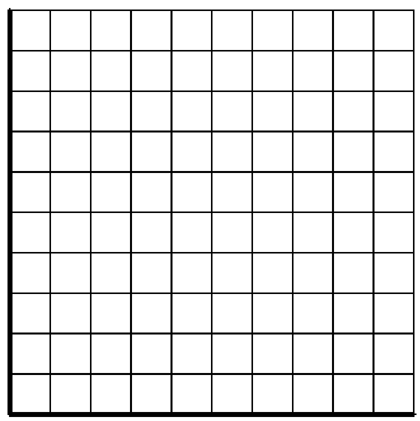
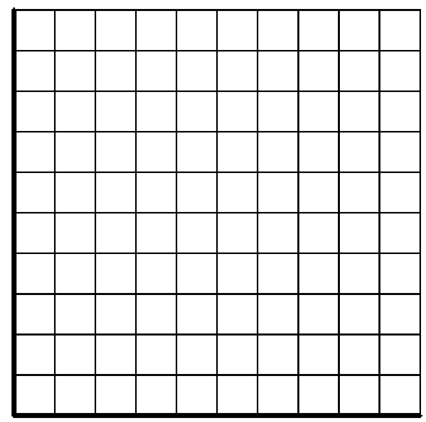
Geometric Distribution Worksheet

1) List the four rules of a geometric setting.
   1.
   2.
   3.
   4.

2) Consider a basketball player shooting free-throws. Produce a probability histogram for an 80% success rate, a 50% success rate and an 20% success rate. The variable of interest is getting the first success at the 7^{th} attempt. Draw them in the grids provided. Comment on the differences in the histograms.







3) Calculate the mean and standard deviation for each of the three success rates listed in problem #2. At which probability value is the spread (standard deviation) the biggest?

80% 50% 20%

4) Write out the formula for calculating probabilities in a geometric setting. Then use the formula to calculate the above free-throw shooter makes the first success on the 7^{th} shot, assuming a 50% success rate.

5) An Olympic archer is able to hit a bulls-eye 80% of the time. Assume each shot is independent of the others. The variable of interest is the first bulls-eye she makes.

a) What is the expected first success? What is the standard deviation?

b) What is the probability that her first success is on the 4^{th} arrow shot.

c) What is the probability that her first success is at most by the 4^{th} arrow shot.

d) What is the probability she gets her first bulls-eye between the 2^{nd} and the 5^{th} arrow shot?

e) What is the probability she gets her first bulls-eye between and including the 2^{nd} and the 5^{th} arrow shot?

f) What is the probability that her first success is beyond the 4^{th} arrow shot.

g) What is the probability that her first success is at least by the 3rd arrow shot.

AP Level Binomial Question:

Coach Weaston recently gave a test to several classes and did an analysis of student performance. The mean (μ) was 83.2 and the standard deviation (σ) was 10.2. For a class of 30 students, what is the probability that 11 students made and A on this test? Assume the distribution of test scores to be approximately normal.

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Review Binomial and Geometric Random Variables

1. List the four conditions of a binomial setting.

2. According to a CBS/*New York Times* poll taken in 1992, 15% of the public have responded to a telephone call-in poll. In a random group of five people, what is the probability that exactly two have responded to a call-in poll?

3. The yearly mortality rate for American men from prostate cancer has been constant for decades at about 25 of every 100,000 men. In a group of 100 American men, what is the probability that at most 2 will die from prostate cancer this year?

4. One of O.J. Simpson's lawyers has stated that 1 out of every 1000 abusive relationships end in murder each year. If he is correct, and if there are approximately 1.5 million abusive relationships in the U.S., what is the expected value for the number of people who are killed each year by an abusive partner?

5. An inspection procedure at a manufacturing plant involves picking three items at random and then accepting the whole lot if at least two of the three items are in perfect condition. In reality, 90% of the whole lot is perfect. What is the probability that the lot will be accepted?

6. Sixty-five percent of all divorce cases cite incompatibility as the underlying reason. If 20 couples file for divorce, what is the probability that:

   A) 5 couples cite incompatibility?

   B) less than 8 couples cite incompatibly?

   C) at least 11 couples cite incompatibility?

   D) at most 15 couples cite incompatibly?

   E) between 12 and 16 couples cite incompatibility?

7. Which of the following lead to binomial distributions?

   I. An inspection procedure at an automobile manufacturing plant involves selecting a sample of cars from the assembly line and noting for each car whether there are no defects, at least one major defect, or only minor defects.

   II. As students study more and more during their AP Stats class, their chances of getting an A on any given test continue to improve. The teacher is interested in the probability of any given student receiving various numbers of A's on the class exams.

   III. A committee of two is to be selected from among the five teachers and ten students attending a meeting. What are the probabilities that the committee will consist of two teachers of two students, or of exactly one teacher and one student?

9. Suppose the probability of a particular baseball player hitting a homerun is 2/11, based on the player's prior history. Assume the probability of the player hitting a homerun is the same for each at-bat and assume the player has 50 at bats during the season.

   A) Explain why this situation is binomial.

   B) Define a random variable for this situation.

10. List the four conditions of a geometric setting.

11. Cards with athlete's pictures are prizes in a certain type of cereal. There is a 20% chance that the card has a picture of Tiger Woods on it.

    a) What is the probability that the first box that has Tiger's picture is the third box that you open?

    b) What is the probability that the first box that has Tiger's picture is at most the third box that you open?

    c) How many boxes of cereal can you expect to open before you first find a picture of Tiger?

    d) What is the standard deviation of this distribution?

12. Police estimate that 80% of drivers now wear their seatbelts. The set up a safety roadblock, stopping cars to check for seatbelt use.

    a) How many cars do they expect to stop before finding a driver whose seatbelt is not buckled?

    b) What is the probability that the first unbelted driver is in the 6^{th} car stopped?

    c) What is the probability that the first 10 drivers are all wearing their seatbelts?

    d) If they stop 30 cars during the first hour, find the mean and standard deviation of the number of drivers expected to be wearing seatbelts.

Part I - Multiple Choice (Questions 1-10) - Circle the answer of your choice.

1. Sixty-five percent of all divorce cases cite incompatibility as the underlying reason. If four couples file for a divorce, what is the probability that exactly two will state incompatibility as the reason?

(a) .104.
(b) .207
(c) .254
(d) .311
(e) .423

2. Which of the following are true statements?

I. The histogram of a binomial distribution with p = .5 is always symmetric.
II. The histogram of a binomial distribution with p = .9 is skewed to the right.
III. The histogram of a geometric distribution with is always decreasing.

(a) I and II
(b) I and III
(c) II and III
(d) I, II, and III
(e) None of the above gives the complete set of complete responses.

3. Binomial and geometric probability situations share many conditions. Identify the choice that is not shared.

(a) The probability of success on each trial is the same.
(b) There are only two outcomes on each trial.
(c) The focus of the problem is the number of successes in a given number of trials.
(d) The probability of a success equals 1 minus the probability of a failure.
(e) The mean depends on the probability of a success.

4. An inspection procedure at a manufacturing plant involves picking thirty items at random and then accepting the whole lot if at least twenty-five of the thirty items are in perfect condition. If in reality 85% of the whole lot is perfect, what is the probability that the lot will be accepted?

(a) .524
(b) .667
(c) .186
(d) .476
(e) .711

5. A recent study of the WA Upper School student body determined that 41% of the students were “chic”. If Mr. Floyd has developed a test for “chic-ness”, what is the average number of students we would need to test in order to find one who is “chic”?

(a) 2
(b) 2.43
(c) 3
(d) 3.57
(e) 1, because the study is clearly in error since all WA students are “chic”

6. A student is randomly generating 1-digit numbers on his TI-83. What is the probability that the first "4" will be the 8th digit generated?

(a) .053
(b) .082
(c) .048
(d) .742
(e) .500

7. The color distribution in a bag of Reese's Pieces was found to be 13 brown, 22 orange, and 15 yellow. If a piece is randomly drawn and replaced, what is the probability that it will take less than 8 draws to get an orange piece?

(a) .014
(b) .008
(c) .990
(d) .983
(e) .500

8. A probability experiment involves a series of identical, independent trials with two outcomes (success/failure) per trial and the probability of a success on each trial is 0.1. Determine the number of trials, n, in a binomial experiment such that the expected number of successes in that binomial experiment will be equal to the expected number of trials in a geometric experiment.

(a) 2
(b) 5
(c) 10
(d) 50
(e) 100

9. Which of the following statements is NOT correct?

(a) The number of successes that corresponds to the maximum value of a binomial PDF is within one unit of it's mean.
(b) A geometric PDF is always decreasing.
(c) A binomial PDF with p < .5 will be skewed right.
(d) As the number of trials in a geometric situation increases and the number of successes in a binomial situation increases, the value of the CDF approaches 0.
(e) A PDF can be transformed into a CDF by using addition.

10. The renowned soccer player, Levi Gupta scores a goal on 30% of his attempts. The random variable X is defined as the number of goals scored on 50 attempts.
The renowned gambler, Mohammed Smith, wins at Blackjack 25% of the time. The random variable Y is defined as the number of games needed to win his first game.
Define the random variable Z as the total number of soccer goals scored and blackjack games played. Determine the mean and standard deviation of the random variable Z.

(a) 11, 6.7
(b) 19, 6.7
(c) 11, 4.74
(d) 19, 4.74
(e) Cannot be determined with the given information.

Part II – Free Response (Questions 11) – Show your work and explain your results clearly.

11. Sophie, Ms. Coley's favorite dog, loves to play catch. Unfortunately, she (Sophie, not Ms. Coley) is not particularly adept at catching as her probability of catching the ball is 0.15.
Ms. Coley is interested in determining how many tosses it will take for Sophie to catch the ball once.

a) Can this situation be described as binomial, geometric, or neither?

b) By making an appropriate assignment of digits, use the random number table to perform 5 simulations of this event. Clearly label your simulations.

48747	76595	32588	38392	84422	80016	37890	71950	22494	00369	61269	87073	73694	97751	17857
52352	21392	58249	80993	52010	88856	23882	73613	57648	47051	63016	73572	22684	02409	37565
52457	01257	40615	63910	03413	77576	74872	57431	29251	77848	98037	81230	38561	69580	06181

c) Using your simulation, what is the expected number of tosses it will take for Sophie to catch the ball once?

d) Using the theoretical distribution you chose in part 1, what is the expected number of tosses?

e) Using the theoretical distribution you chose in part 1, what is the probability it will take 10 tosses in order for Sophie to catch the ball?

Mr. Wylder, avid baseball player & coach, decides to train Sophie. After three-a-day training sessions for 4 weeks, the probability that Sophie catches the ball has increased to 0.35. Mr. Wylder is interested in determining the number of times Sophie will catch the ball in 25 tosses.

f) Can this situation be described as binomial, geometric, or neither?

g) By making an appropriate assignment of digits, use the random number table to perform 4 simulations of this event. Clearly label your simulations.

48747	76595	32588	38392	84422	80016	37890	71950	22494	00369	61269	87073	73694	97751	17857
52352	21392	58249	80993	52010	88856	23882	73613	57648	47051	63016	73572	22684	02409	37565
52457	01257	40615	63910	03413	77576	74872	57431	29251	77848	98037	81230	38561	69580	06181

h) Using your simulation, what is the expected number of times that Sophie will catch the ball?

i) Using the theoretical distribution you chose in part 1, what is the expected number of catches?

j) Using the theoretical distribution you chose in part 1, what is the probability that Sophie will catch the ball 8 times in 25 tosses?

Mr. Myers, knowing that Sophie is just "a dog", determines that the probability that Sophie will catch the ball is 0.50 (After all, either she catches it or she doesn't!!). Mr. Myers would like to find out the number of tosses required for Sophie to catch the ball three times.

k) Can this situation be described as binomial, geometric, or neither?

l) By making an appropriate assignment of digits, use the random number table to perform 4 simulations of this event. Clearly label your simulations.

48747	76595	32588	38392	84422	80016	37890	71950	22494	00369	61269	87073	73694	97751	17857
52352	21392	58249	80993	52010	88856	23882	73613	57648	47051	63016	73572	22684	02409	37565
52457	01257	40615	63910	03413	77576	74872	57431	29251	77848	98037	81230	38561	69580	06181

m) Using your simulation, what is the expected number of tosses that it will take Sophie to catch the ball three times?

Also, study the chapter review items listed in your textbook pages 446 and 447.

Creating a Sampling Distribution

Consider a small **population** consisting of the board of directors of a day care center.

Board member:	Jay	Carol	Allison	Teresa	Lygia	Bob	Roxy	Kevin
Number of children:	2	2	0	0	2	2	0	3

Find the average number of children for the **entire** group of eight:

List all possible samples of size 2. Calculate the average number of children represented by the group.

Sample	$\bar{x}$	Sample	$\bar{x}$	Sample	$\bar{x}$	Sample	$\bar{x}$
Jay and Carol (2+2)/2	2						

Find the average of **all 28 samples** of size 2.

What is the relationship between the population parameter and the average of all possible sample statistics? (What do you notice?)